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NSZO:	**A01N-057/20; A01N-043/76; A01N-043/60**		

Magyar cím:

Hatóanyagként (kinoxalinil-oxi)-fenoxi-propionsav-származékot tartalmazó szinergetikus herbicid készítmény

Angol cím:

SYNERGISTIC HERBICIDAL COMPOSITION COMPRISING (QUINOXALINYLOXY)-PHENOXYPROPIONIC ACID DERIVATIVE AS ACTIVE INGREDIENT

Bejelentő:

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Kivonat:

Herbicid készítmény, amelyre jellemző, hogy herbicid hatású dózisban

A) az (I) képletű vetgyületet és

B) az alábbiakban felsoroltak közül egyet vagy többet tartalmaznak:

B1) a B1) képletű 2-[4-(6-klór-benzoxazol-2-il-oxi-fenoxi]-propionsav és észterei, előnyösen az etilésztere,

B2) a B2) képletű glufoszinát és sói, előnyösen a monoammóniumsója,

B3) főleg répában szelektív hatású herbicidek fenmedifam, dezmedifam, etofumeszat, metamitron, klopiralid és kloridazon csoportjából;

B4) főleg a mezőgazdaságilag termesztett hüvelyesek, így szójabab, lóbab és Phaseolus-bab kultúrájában szelektív hatású herbicidek nitrodifeniléterek, így laktofen, acifluorfen és fomezafen, imidazolinonok, így imazetapir és imazaquin, bentazon és szulfonilkarbamidok, így amidoszulfuron, klorimuron és tiameturonmetil csoportjából,

B5) főleg lenkultúrákban szelektív hatású herbicidek a hidroxibenzotritrilek, pl. bromoxinil és ioxinil, és fenoxiecetsav-származékok, így MPCPA csoportjából, és

B6) főleg a Cruciferae családjának, így réparepce és repce kultúrájában szelektív hatású herbicidek a karbetamid, dimefuron, benazolin és észtereinek, metazaklór és propizamid csoportjából.

H 573

DEPARTMENT OF TRADE AND INDUSTRY
DEPARTEMENT VAN HANDEL EN NYWERHEID

REPUBLIC OF SOUTH AFRICA

REPUBLIEK VAN SUID-AFRIKA

LETTERS PATENT
(PATENTS ACT, 1978)

PATENTBRIEF
(WET OP PATENTE, 1978)

No. 91/8334

WHEREAS
NADEMAAL HOECHST AKTIENGESELLSCHAFT
(Hereinafter called "the Patentee")
(Hieronder "die Patenthouer" genoem)

has applied to me for the grant of a patent in respect of an invention described and claimed in the complete specification deposited at the aansoek by my gedoen het om die verlening van 'n patent ten opsigte van 'n uitvinding wat beskryf is en waarop aanspraak gemaak word

Patent Office under the above-mentioned number, a copy of which is annexed, together with the relevant Form P. 2;
in die volledige spesifikasie wat by die Patentkantoor onder bovermelde nommer ingedien is en waarvan 'n afskrif aangeheg is tesame met

die betrokke vorm P. 2;

NOW THEREFORE these Letters Patent are to grant to the Patentee a patent, the effect of which shall be to grant to the Patentee
SO IS DIT dat hierdie Patentbrief aan die Patenthouer 'n patent verleen wat die uitwerking het dat, behoudens die bepalings van die
in the Republic, subject to the provisions of the Act, for the duration of the patent, the right to exclude other persons from making, using,
Wet, aan die Patenthouer vir die duur van die patent in die Republiek die reg verleen word om ander persone uit te sluit van die vervaar-

exercising or disposing of the invention, so that he shall have and enjoy the whole profit and advantage accruing by reason of the invention.
diging, aanwending, uitoefening of van die handsetting van die uitvinding, sodat hy al die wins en voordeel wat uit die uitvinding voort-

spruit, verkry en geniet.

IN TESTIMONY WHEREOF the seal of the Patent Office has been affixed at Pretoria with effect from the
TER BETUIGING WAARVAN die seël van die Patentkantoor hierop te Pretoria aangebring is met ingang van die

24TH day of dag van JUNE nineteen hundred and eenduisend negehonderd NINETY-TWO

Registrar of Patents/Registrateur van Patente

[See overleaf
[Blaai om

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FORM P.2

REPUBLIC OF SOUTH AFRICA

REGISTER OF PATENTS

PATENTS ACT, 1978

P/91/50599

OFFICIAL APPLICATION NO.	LODGING DATE: PROVISIONAL	ACCEPTANCE DATE
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FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)

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APPLICANTS SUBSTITUTED:	DATED REGISTERED
71	

ASSIGNEE(S)	DATE REGISTERED
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PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
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TITLE OF INVENTION

54 SYNERGISTIC HERBICIDAL COMPOSITIONS

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DMK

P/91/50599

PATENT OF ADDITION NO.	DATE OF ANY CHANGE	
61		
FRESH APPLICATION BASED ON	**DATE OF ANY CHANGE**	

FORM P.2
(Continued)

AMENDMENTS AND RECTIFICATI NS, ETC.

Document	Date of Application	Advertisement Date	Opposition Date	Allowance or refusal	Dat f latter

PROCEEDINGS BEFORE THE COMMISSIONER OF PATENTS

Nature	Taken by:	Against	Date commenced	Date of Order	Appeals to Supreme Court TPD/AD	Date Withdrawn

LICENCES, ATTACHMENTS AND HYPOTHECATIONS

Nature	In favour of:	Date registered	Date cancelled

RENEWALS

Year	Date paid	Receipt	Penalty

RESTORATIONS

Date Applied for	Advertised	Opposed	Restored by	Date of Restoration

REMARKS: (FOR OFFICE USE ONLY)

FORM P.7

D.M. KISCH INC.

Patent Attorneys & Trademark Agents
Attorneys & Notaries

REPUBLIC OF SOUTH AFRICA

THE PATENTS ACT, 1978.

COMPLETE SPECIFICATION

(Section 30 (1) – Regulation 28)

PATENT APPLICATION NO.	
21 01	918334

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FULL NAME(S) OF APPLICANT (S)	
71	HOECHST AKTIENGESELLSCHAFT

FULL NAME(S) OF INVENTOR(S)		
72	ERWIN HACKER MANFRED RÖTTELE MARTIN HEB	HANS SCHUMACHER EMILIO CARLOS TYLSON

TITLE OF INVENTION	
54	SYNERGISTIC HERBICIDAL COMPOSITIONS

HOECHST AKTIENGESELLSCHAFT HOE 90/F 319 Dr.WE/fe

Description

Synergistic herbicidal compositions

The invention relates to the field of the crop protection agents which can be used against monocotyledon and dicotyledon weeds.

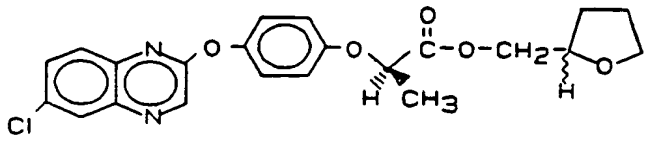
UBI-C 4874 (I) with the chemical name (±)-tetrahydrofurfuryl (2R)-2-[4-(6-chloroquinoxalin-2-yloxy)phenoxy]-propionate is a herbicidal active substance which can be used post-emergence for controlling annual and perennial grass weeds. Application rates of 5-250 g/ha, based on the pure active substance, control a large number of economically important grass weeds in important dicotyledon crop species such as soybeans, beets, cotton, oilseed rape, sunflowers, peas, potatoes, lentils, flax, groundnut, etc. The crop plants tolerate the active substance which is used in the emulsion concentrates for application without qualitative and quantitative changes. The addition of paraffin oils, vegetable oils or wetting agents is indicated for use in practice to guarantee the action or to improve the action.

The active substance is known from publications, for example A.R. Bell et al., Brighton Crop. Protection Conference-Weeds-1989, pages 65-70.

Surprisingly, some herbicidal active substances have now been found in biological tests which, when applied together with UBI-C4874, result in distinctive synergistic effects in the herbicidal activity.

The present invention relates to herbicidal compositions having a herbicidally effective content of a combination of

A) the compound of the formula (I)

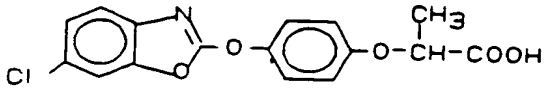


(I)

and

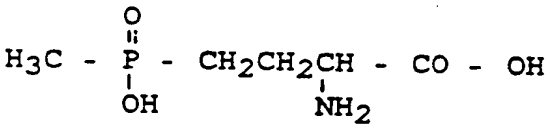
B) one or more compound(s) from the group comprising the compounds

B1) 2-[4-(6-chlorobenzoxazol-2-yloxy)phenoxy]propionic acid (B1) and the esters thereof, preferably the ethyl ester,



(B1)

B2) glufosinate and the salts thereof, preferably the monoammonium salt,



(B2)

B3) herbicides which are mainly selective in Beta beets and are selected from amongst the group comprising phenmedipham, desmedipham, ethofumesate, metamitron, clopyralid and chloridazon,

B4) herbicides which are mainly selective in agriculturally cultivated species from the legume family such as soybean, field bean and phaseolus bean, and which are selected from amongst the group comprising nitrodiphenyl ethers such as lactofen, acifluorfen and fomesafen, imidazolinones such as imazethapyr and imazaquin, bentazone and sulfonylureas such as amidosulfuron, chlorimuron and thiameturon-methyl,

B5) herbicides which are mainly sel ctive in the agricultural crops flax and linseed and which are selected from amongst the group comprising hydroxybenzonitriles such as bromoxynil and ioxynil, and phenoxyacetic acid derivatives such as MCPA,

and

B6) herbicides which are mainly selective in the agricultural crops from the crucifer family such as oilseed rape and turnip rape, and which are selected from amongst the group comprising carbetamide, dimefuron, benazolin and its esters, metazachlor and propyzamide.

All active substances have in common that they are preferably applied post-emergence and taken up via the green parts of the plant.

Compound A (compound of the formula I) is known from the publication mentioned at the outset.

The compounds from groups B1 to B6 are known and mostly described in "The Pesticide Manual", British Crop Protection Council, 8th Ed., 1987; for B1 ("fenoxaprop" and "fenoxaprop-ethyl"), see page 379; for B2 ("glufosinate"), see page 488; for B3, see "phenmedipham" on page 652, 653, "desmedipham" on page 242-243, "ethofumesate" on page 353-354, "metamitron" on page 536, "clopyralid" on page 189-190 and "chloridazon" on page 155-156; for B4, see, for example, "acifluorfen" on page 3, "fomesafen" on page 428, "imazethapyr" on page 475, "imazaquin" on page 474, "bentazone" on page 63-64; for B5 see, for example, "bromoxynil" on page 100-102, "ioxynil" on page 479-482 and "MCPA" on page 514-517; for B6, see, for example, "dimefuron" on page 293, "benazolin" on page 51-52, "metazachlor" on page 537, "propyzamide" on page 720 and "carbetamide" on page 129.

Some of the abovementioned active substances are described in Farm Chemicals Handbook '90, Meister Publishing Company, Willoughby, Ohio, USA 1990, for example for B4, see common names "lactofen" on page C 72, "chlorimuron" and "chlorimuron-ethyl" on page C 72. "Thiameturon-methyl" corresponds to DPX-MG316, see Farm Chemicals Handbook, page C 152.

"Amidosulfuron", i.e. 3-(4,6-dimethoxypyrimidin-2-yl)-1-(N-methyl-N-(methylsulfonyl)-aminosulfonyl)-urea is a sulfonylurea herbicide for controlling dicotyledon weeds in cereals (cf. Z. Pfl. Krankh. Pfl./Schutz, Sonderheft [Special Issue] XII, 489-497 (1990)).

Fenoxaprop-ethyl is a herbicidal active substance for controlling grass weeds in agricultural crops such as soybeans, oilseed rape, sugar beet, potatoes, inter alia. It was first described in DE 2,640,730. In the meantime, it has been used in the form of the racemate and even as the optically active D(+) isomer (common name: fenoxaprop-P-ethyl). The racemate and P(+) isomer and their mixtures can be employed according to the invention and come under formula B1.

Glufosinate-ammonium is a foliar-acting herbicide which is used post-emergence for controlling broad-leaved weeds and grass weeds in plantation crops and on uncultivated land and, by means of specific application techniques, also for treatments between rows in large-area agricultural crops such as corn, cotton, etc. Formula B2 also embraces the optical isomers of glufosinate, in particular also L-phosphinothricin and the ammonium salt thereof.

Herbicidal compositions according to the invention which contain the compound of the abovementioned formula (I) and one of the compounds B1 to B6 are of particular interest.

Other preferred herbicidal compositions are those which contain the compound of the formula (I) in combination with fenoxaprop-ethyl, fenoxaprop-P-ethyl, glufosinate-ammonium or one or more compounds from amongst the group comprising phenmedipham, ethofumesate and metamitron, or one or more compounds from the group comprising lactofen, imazethapyr, imazaquin and thiamethuron-methyl, or one or more compounds from the group comprising MCPA and bromoxynil, or one or more compounds from amongst the group comprising carbetamide, dimefuron and benazolin or its esters.

The herbicidal compositions according to the invention have an excellent herbicidal activity against a broad range of economically important monocotyledon and dicotyledon harmful plants. The active substance combination also acts efficiently on perennial weeds which produce shoots from rhizomes, rootstocks or other perennial organs and which are difficult to control. Specifically, examples may be mentioned of some representatives of the monocotyledon and dicotyledon weed flora which can be controlled by the compositions according to the invention, without the enumeration being a restriction to certain species.

Examples of weed species on which the active substance acts efficiently are, from amongst the monocotyledons, Avena, Lolium, Alopecurus, Phalaris, Echinochloa, Digitaria, Setaria and also Cyperus species from the annual sector and from amongst the perennial species Agropyron, Cynodon, Imperata and Sorghum, and also perennial Cyperus species.

In the case of the dicotyledon weed species, the range of action extends to Galium, Viola, Veronica, Lamium, Chenopodium, Atriplex, Stellaria, Amaranthus, Sinapis, Ipomoea, Matricaria, Anthemis, Abutilon and Sida from amongst the annuals, and Convolvulus, Cirsium, Rumex and Artemisia in the case of the perennial weeds.

If the active substance combinations are applied post-emergence on the green parts of the plants, growth likewise stops drastically a very short time after the treatment and the weed plants remain at the growth stage of the point of time of application, or they die completely after a certain time more or less rapidly, so that in this manner competition by the weeds, which is harmful to the crop plants, can be eliminated at a very early point in time and in a sustained manner by using the novel compositions according to the invention.

Even though the compositions according to the invention have an excellent herbicidal activity against monocotyledon and dicotyledon weeds, crop plants of economically important crops, such as, for example, beets, oilseed rape, field beans, soybeans, flax and others, are damaged not at all, or only to a negligible extent. For these reasons, the compositions are highly suitable for selectively controlling undesired plant growth in plantings for agricultural use or in perennial cultures or in the non-selective sector. The area of use depends on the range of action or on the selectivity of the individual active substances and can be roughly estimated from the known data on the individual active substances.

The active substance combinations according to the invention allow, for example, a herbicidal action to be achieved which exceeds what would have been expected as an additive action of the individual components. Such improved actions allow the application rates of the individual active substances to be substantially reduced. At comparable application rates, the synergistic effects make the controlled broad-leaved weed/grass weed range considerably wider. At the same time, properties, which are of utmost importance in practical use, are considerably improved in most combinations. This includes, for example, the speed of action, the long-term action, the flexibility in use, and others. This permits comprehensive, rapid, long-lasting and economical control of grass

weeds and broad-leaved weeds. Such properties are economically progressive because they allow the user considerable advantages in practical weed control by enabling him to control weeds more economically or faster or over a long period of time or with a lower number of individual applications to be carried out, and therefore to obtain higher yields in a stand of crop plants.

The mixing ratios A : B can vary within wide limits and are generally 100 : 1 to 1 : 1000, based on weight. The mixing ratio is selected as a function of, for example, the component in the mixture, the development stage of the weeds, crop species, grass weeds, range of weeds, environmental factors and climatic conditions. It is preferred to use mixing ratios of from 15 : 1 to 1 : 700, in particular

A : B1 from 10 : 1 to 1 : 5
A : B2 from 1 : 8 to 1 : 200
A : B3 from 5 : 1 to 1 : 700
A : B4 from 15 : 1 to 1 : 400
A : B5 from 2 : 1 to 1 : 200
A : B6 from 1 : 4 to 1 : 500.

The application rates of herbicide A in the active substance mixtures are preferably between 5 and 120 g/ha, the application rates of the active substances from groups B1-B6 from 5 to 4000 g/ha, in particular, in the case of B1, from 5 to 120 g/ha, of B2, from 100 to 1000 g/ha, of B3, from 100 to 4000 g/ha, of B4, from 5 to 2000 g/ha, of B5, from 100 to 2000 g/ha, and in the case of B6 from 500 to 1700 g/ha.

The active substance combinations according to the invention can exist either as mixed formulations of the two, or of more, components, and these are then applied in the customary fashion, namely diluted with water, or they can be prepared in the form of so-called tank mixes by conjointly diluting the separately formulated

components with water.

The compounds A and B or the combinations thereof can be formulated in a variety of ways, as predetermined by the biological and/or chemico-physical parameters. The following possibilities are therefore suitable for formulation: wettable powders (WP), emulsifiable concentrates (EC), aqueous solutions (SL), emulsions (EW) such as oil-in-water and water-in-oil emulsions, sprayable solutions or emulsions, dispersions on an oil or water base, suspoemulsions, dusts (DP), granules such as water-dispersible granules (WG), ULV formulations, microcapsules or waxes.

These abovementioned formulation types are known in principle and are described, for example, in: Winnacker-Küchler, "Chemische Technologie" [Chemical Technology], Volume 7, C. Hauser Verlag Munich, 4th Ed. 1986; van Valkenburg, "Pesticides Formulations", Marcel Dekker N.Y., 2nd Ed. 1972-73; K. Martens, "Spray Drying Handbook", 3rd Ed. 1979, G. Goodwin Ltd. London.

The formulation auxiliaries required, such as inert materials, surfactants, solvents and other additives, are also known and are described, for example, in: Watkins, "Handbook of Insecticide Dust Diluents and Carriers", 2nd Ed., Darland Books, Caldwell N.J.; H.v.Olphen, "Introduction to Clay Colloid Chemistry", 2nd Ed., J. Wiley & Sons, N.Y.; Marsden, "Solvents Guide", 2nd Ed., Interscience, N.Y. 1950; McCutcheon's, "Detergents and Emulsifiers Annual", MC Publ. Corp. Ridgewood N.J.; Sisley and Wood, "Encyclopedia of Surface Active Agents", Chem. Publ. Co. Inc., N.Y. 1964; Schönfeldt, "Grenzflächenaktive Äthylenoxidaddukte" [Surface-active Ethylene Oxide Adducts], Wiss. Verlagsgesell., Stuttgart 1976; Winnacker-Küchler, "Chemische Technologie" [Chemical Technology], Volume 7, C. Hauser Verlag Munich, 4th Ed. 1986.

Combinations with other pesticidally active substances, such as other herbicides, fungicides or insecticides, and also safeners, fertilizers and/or growth regulators may also be prepared on the basis of these formulations, for example in the form of a readymix formulation or as a tank mix.

Wettable powders are preparations which are uniformly dispersible in water and which, besides the active substance, also contain wetting agents, for example polyoxethylated alkylphenols, polyoxethylated fatty alcohols or fatty amines, fatty alcohol polyglycol ether sulfates, alkanesulfonates or alkylbenzenesulfonates, and dispersing agents, for example sodium ligninsulfonate, sodium 2,2'-dinaphthylmethane-6,6'-disulfonate, sodium dibutylnaphthalenesulfonate, or alternatively sodium oleylmethyltaurinate, in addition to a diluent or inert substance.

Emulsifiable concentrates are prepared by dissolving the active substance in an organic solvent, for example butanol, cyclohexanone, dimethylformamide, xylene and also higher-boiling aromatic compounds or hydrocarbons, with the addition of one or more emulsifiers. Examples of emulsifiers which can be used are: calcium salts of an alkylarylsulfonic acid, such as Ca dodecylbenzene-sulfonate, or non-ionic emulsifiers, such as fatty acid polyglycol esters, alkylaryl polyglycol ethers, fatty alcohol polyglycol ethers, propylene oxide/ethylene oxide condensation products, alkyl polyethers, sorbitan fatty acid esters, polyoxyethylene sorbitan fatty acid esters or polyoxyethylene sorbitol esters.

Dusts are obtained by grinding the active substance with finely divided solid substances, for example talc or natural clays, such as kaolin, bentonite and pyrophyllite or diatomaceous earth.

Granules can be produced either by spraying the active

substance onto adsorptive, granulated inert material or by applying active substance concentrates onto the surface of carriers, such as sand, kaolinites or granulated inert material, by means of binders, for example polyvinyl alcohol, sodium polyacrylate or, alternatively, mineral oils. Suitable active substances can also be granulated in the manner which is conventional for the production of fertilizer granules, if desired in a mixture with fertilizers.

The agrochemical preparations generally contain 0.1 to 99 percent by weight, in particular 2 to 95 % by weight, of active substances A + B. The concentrations of the active substances A + B can vary in the formulations.

The concentration of active substance in wettable powders is, for example, about 10 to 95 % by weight; the remainder to 100 % by weight is composed of conventional formulation components. In the case of emulsifiable concentrates, the concentration of active substance can be about 1 to 85 % by weight, preferably 5 to 80 % by weight. Formulations in the form of dusts contain about 1 to 25 % by weight, usually 5 to 20% by weight of active substance, sprayable solutions about 0.2 to 25 % by weight, preferably 2 to 20% by weight. In the case of granules such as water-dispersible granules, the active substance content depends partly on whether the active compound is liquid or solid and on which granulation auxiliaries and fillers are used. As a rule, the content in the water-dispersible granules is between 10 and 90 % by weight.

In addition, the active substance formulations mentioned contain, if appropriate, the adhesives, wetting agents, dispersing agents, emulsifiers, penetrants, solvents, fillers or carriers which are conventional in each case.

For use, the formulations, present in commercially available form, are diluted, if appropriate, in a

customary manner, for example using water in the case of wettable powders, emulsifiable concentrates, dispersions and water-dispersible granules. Preparations in the form of dusts or granules for soil application and for broadcasting and also sprayable solutions are usually not further diluted with other inert substances before use.

The application rate required for the compounds of the formula I varies with the external conditions, such as, inter alia, temperature, humidity, and the nature of the herbicide used.

The examples which follow serve to illustrate the invention:

A. Formulation Examples

a) A dust is obtained by mixing 10 parts by weight of an active substance combination according to the invention and 90 parts by weight of talc as inert substance and comminuting the mixture in a hammer mill.

b) A wettable powder which is readily dispersible in water is obtained by mixing 25 parts by weight of active substance A + B, 64 parts by weight of kaolin-containing quartz as the inert substance, 10 parts by weight of potassium ligninsulfonate and 1 part by weight of sodium oleoylmethyltaurinate as the wetting and dispersing agent, and grinding the mixture in a pinned disk mill.

c) A dispersion concentrate which is readily dispersible in water is obtained by mixing 20 parts by weight of active substance A + B with 6 parts by weight of alkylphenol polyglycol ether (®Triton X 207), 3 parts by weight of isotridecanol polyglycol ether (8 EO) and 71 parts by weight of paraffinic mineral oil (boiling range, for exampl , about

255 to above 277°C), and grinding the mixture in a ball mill to a fineness of below 5 microns.

d) An emulsifiable concentrate is obtained from 15 parts by weight of active substances A+B, 75 parts by weight of cyclohexanone as the solvent and 10 parts by weight of oxethylated nonylphenol as the emulsifier.

e) Water-dispersible granules are obtained by mixing

75 parts by weight		of active substances A + B,
10	"	of calcium ligninsulfonate,
5	"	of sodium lauryl sulfate,
3	"	of polyvinyl alcohol and
7	"	of kaolin,

grinding the mixture on a pinned disk mill, and granulating the powder in a fluidized bed by spraying on water as the granulation liquid.

f) Water-dispersible granules are also obtained by homogenizing and precomminuting on a colloid mill,

25 parts by weight		of active substances A + B,
5	"	of sodium 2,2'-dinaphthylmethane-6,6'-disulfonate,
2	"	of sodium oleoylmethyltaurinate,
1 part by weight		of polyvinyl alcohol,
17 parts by weight		of calcium carbonate and
50	"	of water,

subsequently grinding the mixture on a bead mill, and atomizing and drying the resulting suspension in a spray tower by means of a single-compound nozzle.

For example, the active substance combinations from Table 1 below are formulated following the formulations described under a) to f):

Table 1

Active substance A	Active substance B	Ratio A:B
(I)	Fenoxaprop-P-ethyl	10:1
		1:1
		1:5
(I)	Glufosinate-ammonium	10:1
		1:1
		1:5
(I)	Phenmedipham	5:1
		1:1
		1:10
(I)	Lactofen	15:1
		5:1
		1:1
		1:100
(I)	Bromoxynil	2:1
		1:1
		1:100
		1:200
(I)	Benazolin-ethyl	5:1
		2:1
		1:1
		1:10

B. Biological Examples

Under field conditions, trial fields with sandy loam soil were seeded with winter oilseed rape (BRSNW) following customary agricultural practices (seeding time August, seed density 5 kg/ha, fertilization following customary agricultural practices). After the crop plants had emerged, a high degree of infestation with Agropyron repens (AGRRE) and volunteer barley (HORVW) became

apparent. When these grass weeds were in the 1- to 3-leaf stage, or when tillering began (21), the active substance combinations according to the invention which had been formulated in the form of wettable powders or emulsion concentrates and, in parallel trials, the correspondingly formulated individual active substances (see Table 2) were then applied in the form of aqueous suspensions or emulsions to the surface of the trial area, using an application rate of 300 to 800 l of water/ha (converted) in various dosages.

40 days after application, the herbicidal effects were determined by visual scoring of the damage to the plants compared with untreated plants. In all cases, the experimenter distinguished between the calculated and the found degree of effectiveness in the combinations. The calculated degree of effectiveness of a combination, which was to be expected theoretically, is determined by S.R. Colby's formula: Calculation of synergistic and antagonistic responses of herbicide combinations, Weeds 15 (1967) 20-22.

This formula reads:

$$E = X + Y - \frac{X \cdot Y}{100}$$

where
X is % damage by herbicide A at an application rate of x kg/ha;
Y is % damage by herbicide B at an application rate of y kg/ha;
E = damage by herbicides A + B to be expected at a rate of x + y kg/ha.

If the actual damage is greater than the damage to be expected following calculations, then the action of the combination is superadditive, i.e. a synergistic effect

of action exists.

The active substance combinations according to the invention have a herbicidal action which is greater than would have been expected based on the actions of the individual components observed when used by themselves. The active substance combinations therefore show synergistic behavior (cf. Table 2).

Table 2: Active substance combination UBI-C 4874 (I) plus fenoxaprop-P-ethyl

Active substances	Dosage rate [g of ai/ha]	% damage 40 days after application [stage of application] AGRRE [11-21]	HORVW [13]	BRSNW [19]
I	15	43	35	0
	30	56	86	0
	45	67	88	0
	60	85	95	0
B1.1	15	0	20	0
	30	0	20	0
	45	3	27	0
I+B1.1	15+15	77 (43)	58 (48)	0
	15+30	78 (56)	80 (48)	0
	15+45	83 (45)	87 (53)	0
	30+15	73 (43)	89 (88)	0
	30+30	80 (56)	92 (88)	0
	30+45	88 (57)	95 (89)	0
	45+15	86 (43)	95 (90)	0
	45+30	92 (56)	97 (90)	0
	45+45	94 (64)	98 (91)	0

Table 2, abbreviations:

I = UBI-C 4874 as a 12 % emulsion concentrate (EC 120) and 5 l/h oil
B1.1 = fenoxaprop-P-ethyl as a 7.5 % oil-in-water emulsion
ai = active ingredient (based on pure active substance)
( ) = expected value an according to Colby

Table 2 shows that the herbicidal activity of UBI-C 4874, applied as mixture with oil, is markedly increased when applied together with fenoxaprop-ethyl. In the case of Agropyron repens and volunteer barley, there exist synergistic increases in action. In the case of Agropyron repens, the action of the herbicide combinations even exceeds the formal sum of the action of the individual active substances. In the case of volunteer barley (HORVW), the expected values of the herbicide combination, calculated theoretically by COLBY's formula, are also clearly exceeded in the trial.

The crop compatibility in the case of winter oilseed rape (BRSNW) is neither impaired by the individual active substances nor by the herbicide combinations.

Example 2

Under natural field conditions, annual grass weeds had emerged on uncultivated land.

When development stages 25 to 29 (middle to end of tillering phase) had been reached, the herbicides given in Table 3, on their own and in combination, were applied to parts of plots of size 10 m^2 using plot sprayers (analogously to Example 1). 28 days after application, the herbicidal activity of the treat d parts of plots was recorded by visual scoring (analogously to Example 1) in comparison with the untreated control plots. Plant

damage, and plant growth and development, were evaluated in percentages.

The results are compiled in Table 3.

Table 3: Active substance combination UBI-C 4874 (I) plus glufosinate-ammonium

Active substances	Dosage rate [g of ai/ha]	% damage 28 days after application [stage of application] PHAMI [25]	PHAPA [25]	HORVS [29]	BRODI [29]
I	30	15	0	42	65
B2.1	300	50	40	27	35
	600	97	96	65	85
I+B2.1	30+300	95	94	100	100

Table 3, abbreviations:

I = UBI-C 4874 as a 12 % emulsifiable concentrate
B2.1 = glufosinate-ammonium as a 20 % aqueous solution
ai = active ingredient based on pure active substance

The activity of the herbicide combination is clearly above the action of the individual active substances and is comparably good, or even better, than the action of twice the application rate of glufosinate-ammonium on its own. The synergistic effects allow a better and broader activity to be achieved with smaller amounts of active substance.

Example 3

Sugar beets were grown on trial fields following customary agricultural practice. When the sugar beets (BEAVU) had emerged, a high degree of infestation with cockspur grass (Echinochloa crus galli = ECGCR) and wild oats (Avena fatua = AVEFA) became apparent.

In the development stage mid-tillering (E 25) to end of tillering (E 29), the herbicides on their own and their combination were applied analogously to Example 1 using plot sprayers (300 liters of water/ha). 14 days, or 28 days, after the application, the herbicidal effects on the grass weeds or crop plants were determined by visual scoring.

The results are recorded in Table 4.

Table 4: Active substance combination UBI-C 4874 (I) plus phenmedipham

Active substances	Dosage rate in g of ai/ha	% damage at [stage of application] ECGCR [25-29]	AVEFA [25-29]	BEAVU [6-8 leaves]
development stage at application				
I	30	15	65	0
	60	90	85	0
B3.1	942	10	25	0
	1256	15	75	0
I+B3.1	30+942	75 (23)	85(74)	0
	60+942	98 (91)	97(89)	0

Table 4, abbreviations:

I = UBI-C 4874 together with 2 l/ha oil
B3.1 = phenmedipham together with 2 l/ha oil
I+B3.1 = UBI-C 4874 + phenmedipham + 2 l/ha oil
( ) = expected value according to Colby

The results show that in the case of joint application the herbicidal activity is markedly above the effects of the herbicides on their own, even at higher application rates. The expected values according to COLBY are clearly exceeded.

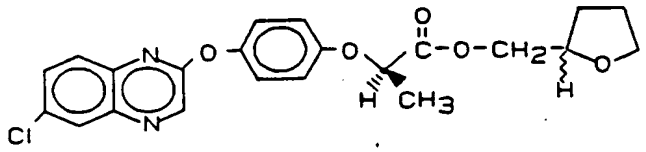
Besides, both grass weeds are controlled with equally good activity, in contrast to the application of the individual active substances, which allows the synergistic effects to broaden the range of action while simultaneously reducing the active substances.

The crop plants are damaged neither by the herbicides on their own nor by the combination thereof.

~~Patent claims:~~

1. A herbicidal composition having a herbicidally effective content of

A) the compound of the formula (I)

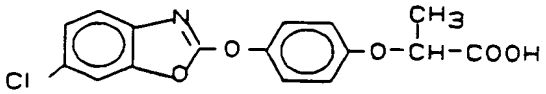


(I)

and

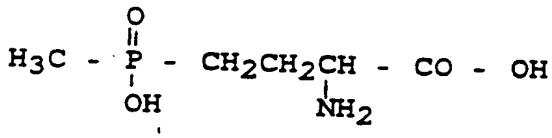
B) one or more compound(s) from the group comprising the compounds

B1) 2-[4-(6-chlorobenzoxazol-2-yloxy)phenoxy]propionic acid (B1) and the esters thereof, preferably ethyl ester,



(B1)

B2) glufosinate and the salts thereof,



(B2)

B3) herbicides which are mainly selective in Beta beets and are selected from amongst the group comprising phenmedipham, desmedipham, ethofumesate, metamitron, clopyralid and chloridazon,

B4) herbicides which are mainly selective in agriculturally cultivated species from the legume family and which are selected from amongst the group comprising nitrodiphenyl ethers, imidazolinones,

bentazone and sulfonylureas,

B5) herbicides which are mainly selective in the agricultural crops flax and linseed and which are selected from amongst the group comprising hydroxybenzonitriles and phenoxyacetic acid derivatives

and

B6) herbicides which are mainly selective in the agricultural crops from the crucifer family and which are selected from amongst the group comprising carbetamide, dimefuron, benazolin and its esters, metazachlor and propyzamide.

2. The composition as claimed in claim 1, which contains a compound of the formula (I) and a compound from amongst the groups B1 to B6.

3. The composition as claimed in claim 1 or 2, which contains 0.1 to 99 % by weight of the active substances A and B, besides customary formulation auxiliaries.

4. The composition as claimed in one or more of claims 1 to 3, which contains the active substances A and B in a ratio by weight of 100 : 1 to 1 : 1000.

5. The composition as claimed in claim 4, in which the ratio by weight is 15 : 1 to 1 : 700.

6. A process for preparing a composition as claimed in one or more of claims 1 to 5, which comprises formulating one or more compounds A with one or more compounds B analogously to a customary crop protection agent formulation from the group comprising wettable powders, emulsifiable concentrates, aqueous solutions, emulsions, sprayable solutions (tank mix), dispersions on an

oil or water base, suspoemulsions, dusts, water-dispersible granules, ULV formulations, microcapsules and waxes.

7. A method of controlling undesirable plants, which comprises applying a herbicidally effective amount of one of the combinations of active substances A + B, defined in one or more of claims 1 to 5, to these undesirable plants or their cultivation areas.

8. The method as claimed in claim 7, in which weeds in crops of useful plants are controlled selectively.

9. The process as claimed in claim 8, in which the crop of useful plants is from amongst the group of the dicotyledon crop species or perennial crops.

10. The use of the herbicidal agent as claimed in one or more of claims 1 to 5 for selectively or non-selectively controlling weeds.

11. A herbicidal composition according to claim 1 substantially as herein described with reference to Table I of active substance combinations.

12. A process for preparing a composition according to claim 1 substantially as herein described with reference to the formulation examples and table I.

13. The use of a herbicidal composition according to claim 11 for selectively or non-selectively controlling weeds.

Dated this 18th day of October 1991

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